Looking at Mathematical Proof – through questions and problems

1. What do you understand about the connection between "truth" and "proof" in general?

2. What do you understand about the connection between "truth" and "proof" in Mathematics?

3. What do you understand to be the differences between deductive proof (or reasoning) and inductive proof (or reasoning)?

4. In the space below, give a simple example of a mathematical deductive proof.

5. Try proving the following by mathematical induction:

(a) $1 + 2 + 3 + 4 + 5 + \ldots + (n - 1) + n = \frac{1}{2}n(n + 1)$

(b) $1^2 + 2^2 + 3^2 + 4^2 + \ldots + (n-1)^2 + n^2 = \frac{n(n+1)(2n+1)}{6}$

(c) $4^n + 2$ is divisible by 3 for all n

6. Use the Proof by *reductio ad absurdum* method to prove that is irrational

7. What do you understand by the term "Proof by Exhaustion"? How/when might it be suitable in Mathematics?

8. What do you know about visual proof in mathematics? Give an example of when it is used.

9. A theorem I just invented – every odd number bigger than 1 can be written as the sum of a prime number and a power of 2.

eg $7 = 2^2 + 3$
$21 = 2^4 + 5$

Try other examples.
What makes this rule very difficult to prove?
What would make this rule very easy to disprove?

10. Can everything in Mathematics be proved (disproved)? Is it possible to prove two conflicting ideas simultaneously?